

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Region 5

R-5 FSH 2609.23

FISHERIES HABITAT EVALUATION HANDBOOK

FOREST SERVICE HANDBOOK
San Francisco, California

R-5 FSH 2609.23 - FISHERIES HABITAT EVALUATION HANDBOOK

Amendment No. 1

Effective July 14, 1992

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Digest:

Removes obsolete, erroneously titled Fisheries Survey Handbook and replaces it with this new Fisheries Habitat Evaluation Handbook.

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Regional Forester

FISHERIES HABITAT EVALUATION HANDBOOK

ZERO CODE

CHAPTER

100	PERSONNEL, CONTROL AND PLANNING ..
200	STREAM HABITAT ASSESSMENT
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FISHERIES HABITAT EVALUATION HANDBOOK

ZERO CODE

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FISHERIES HABITAT EVALUATION HANDBOOK

ZERO CODE

This handbook is designed to aid fisheries biologists in providing ecological records adequate to build logical, biologically well-founded Forest land management plans that appropriately address aquatic riparian habitats in accordance with FSM 2624.4 and FSM 2526.

010 - AUTHORITY. See FSM 2601.1 for the major laws and Executive Orders that provide authority to manage fisheries resources.

020 - OBJECTIVES. Provide uniform instructions for the planning, implementation, evaluation, and application of inventories for stream and lake habitat.

1. Establish a standard method. (This can be built upon based on the specific needs of the individual forest.)

2. Identify and quantify fisheries and aquatic riparian habitats on the National Forests.

3. Conduct inventories to meet forest management need.

4. Collect inventory and monitoring data, (1) in areas where active land management is anticipated or occurring, (2) upon which to predict or evaluate environmental impacts and, (3) base management decisions.

040 - RESPONSIBILITY. Aquatic habitat management on National Forest lands is primarily the responsibility of the Forest Service. Fish management is primarily the responsibility of State Fish and Game Departments. Other Federal agencies such as USDI-Fish and Wildlife Service, USDI-Bureau of Land Management, and USDI-National Marine Fisheries Service, have similar interests in, and needs for aquatic habitat information.

1. Regional Forester. The Regional Forester is responsible for the development and implementation of aquatic habitat survey methods for assessing the condition and trend of aquatic-riparian and fisheries habitat within National Forest lands.

Regional Office staff shall assist Forest Supervisors in survey planning and training, as well as in the review and interpretation of survey results. The Director of Fish and Wildlife Management shall conduct an annual review of this Handbook to ensure its current level of applicability and/or make final recommendations for any proposed modification or amendment.

2. Forest Supervisor. Forest Supervisors are responsible for survey planning and field implementation.

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Forest Staff Officers and fisheries biologists/hydrologists shall become familiar with inventory objectives and procedures so they can review, apply, explain, and make suggestions for improvement. Completion of the data forms is the responsibility of each crew leader. Analysis and interpretation of the data is the responsibility of the biologist or whomever uses it (Chap. 200).

060 - COOPERATION. The cooperative agencies listed in section 040 contribute input during the development of the survey procedures. Basic requirements to maintaining cooperative relations with other agencies are:

1. To jointly plan aquatic habitat surveys with State Fish and Game representatives, BLM, Fish and Wildlife representatives, and other interested agencies or groups (Chap. 200).

2. To ensure that efforts to amend or modify the aquatic habitat survey should involve other agencies in the review of proposed changes.

Coordination within the Forest Service requires developing survey plans at the forest level, according to identified site-specific needs. Coordination with other Forest Service specialists (soil scientists, hydrologists, and others), is required before and during the actual data collection phase of aquatic habitat evaluation. This is necessary to correctly prioritize survey locations and identify the intensity of surveys required at each location for a given time frame. In many instances, data needed by the Wildlife and Fish Program and the Range and Watershed Management Program is similar and can be collected jointly, for example W.I.N. inventories and Channel Stability Inventories.

Five-year implementation schedules based on forest plan needs can be used successfully to prioritize broad assessment needs and locations. Forest Supervisors shall develop and use a yearly study plan to coordinate information needs with other resource managers for specific activities and sites.

070 - REFERENCES. Listed below are the publications referenced within this handbook. This information is necessary to perform the tasks required by the handbook.

Azuma, D., S. Mori. 1990. General Aquatic Resources Monitoring. FHR Currents number 2, USDA Forest Service, Pacific Southwest Region, San Francisco, California. 2pp.

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Gregory, K. G. 1966. Dry Valleys and the Composition at the Drainage Nets. Journal of Hydrology 4: 327-340

McCain, M., D. Fuller, L. Decker, and k. Overton. 1990. Stream habitat classification and inventory procedures for Northern California. FHR Currents number 1, USDA Forest Service, Pacific Southwest Region, San Francisco, California. 15pp.

Platts, William S., C. Armour, G. D. Booth, M. Bryant, J. L. Bufford, P. Cuplin, S. Jensen, G. W. Lienkaemper, G. W. Minshall, S. B. Monsen, R. L. Nelson, J. R. Sedell, J. S. Tuhy. Methods for evaluating riparian habitats with applications to management. General Technical Report INT-221. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1987. pgs 58-60.

Rosgen, D. 1985. A Stream Classification System. In symposium on riparian ecosystems and their management: reconciling conflicting uses., April 16-18, Tucson, Arizona. pgs 91-95 with appendix.

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CHAPTER 100 - PERSONNEL, CONTROL, AND PLANNING

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FISHERIES HABITAT EVALUATION HANDBOOK

CHAPTER 100 - PERSONNEL, CONTROL, AND PLANNING

110 - PERSONNEL. Conduct inventories for Steps I to IV (Chapter 200) using the following techniques and personnel:

1. Step I - Watershed Overview. A fisheries biologist/hydrologist shall train and supervise employees performing watershed overviews.

2. Step II - Habitat Inventories.

a. Habitat inventories require both field and office work.

b. Field crews require a minimum of two people for safety and efficiency. One must be familiar with the technical aspects of the procedure and have a strong interest in fisheries science, preferably a fisheries or biological technician or fisheries biologist/hydrologist.

A fisheries biologist/hydrologist experienced in conducting stream inventories shall supervise the crew performing the field and office work.

3. Step III - Project Design and Evaluation. This requires a site specific inventory and monitoring plan designed by a fisheries biologist/hydrologist. The biologist designing the inventory shall be familiar with current techniques of project design. The crew(s) doing the field and office work shall meet the same training and/or experience as in item 2 and shall be supervised by a fisheries biologist/hydrologist.

4. Step IV - Fish Habitat Relationship. A fish biologist/fish scientist shall perform step IV inventory design and direction on a specifically selected site. The fish biologist/fish scientist shall direct studies and research.

120 - REVIEW AND APPROVAL. The fisheries biologist supervising the employees performing Step I shall review and approve the data forms.

The crew leader shall prepare a written summary including:

1. Any voids in data collection.

2. Problems encountered in use of Handbook instructions.

3. Discrepancies between the stream(s) encountered in the field and those marked on maps.

4. A summary of time and personnel spent conducting the inventory.

The supervising fisheries biologist is responsible for the review and approval of the written summary.

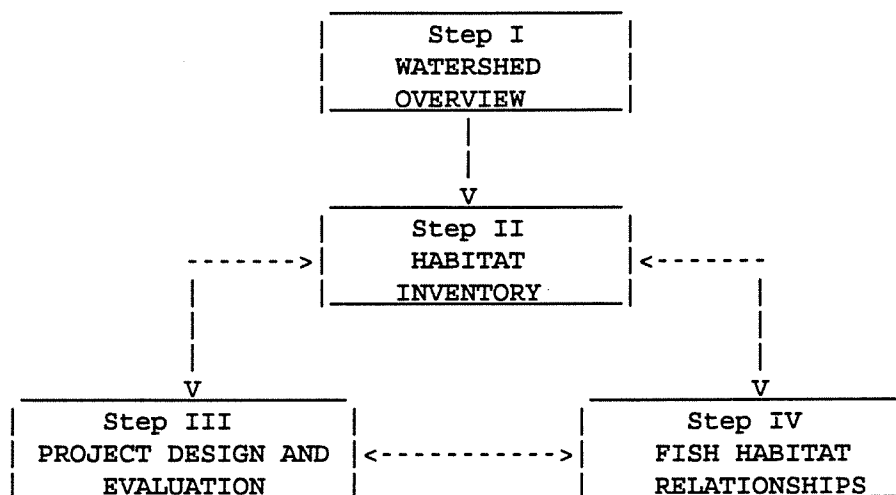
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130 - EVALUATION. The fisheries biologist in charge shall continually review the analysis and recommendations while the inventories are underway.

During forest and Regional reviews check for compliance with processes and procedures specified in this handbook.

140 - PLANNING. Planning for and maintenance of a good inventory is key to successful, efficient use of these surveys. Ensure accomplishment of steps I and II. Overall, biologically steps II, III, and IV are interrelated and cyclic; whereas program-wise the steps tend to be progressive (I-II-III-IV). See exhibit 1.

EXHIBIT 1



141 - Planning Process.

141.1 - Frequency. Update forest fisheries habitat inventory and monitoring plans annually prior to initiation of field season.

141.2 - Coverage. Incorporate a fish habitat evaluation plan into each Forest Land Management Plan. The evaluation plan shall include inventories, improvements, monitoring as well as the projected personnel needs, and approximate costs needed to accomplish the plan.

141.3 - Coordination and Cooperation. Coordinate the plan with other resource needs, (for example, timber, recreation, visual, wildlife, soils, and water). The biologist/hydrologist developing the plan shall cooperate with government agencies, private groups, and concerned individuals.

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141.4 - Format. The annual update of the evaluation plan shall be site specific for each drainage. Provide the following specific information:

1. Location of stream, lake, or drainage.
2. National locator code (watershed code-see R-5 FSH 2509.24) for streams and lakes.
3. Inventory schedule.
4. Estimated length of stream(s) and/or acres of lake(s) in the drainage system and proportion to survey.
5. Step identification. If steps vary throughout the drainage system, explain which step and location to perform, or diagram the area on a map.

141.5 - Budget. An important part of planning is to develop an appropriate budget to meet objectives. Various budget components to consider are:

1. Objectives, (for example, X-miles of stream to inventory).
2. Personnel, (number of employees necessary to complete objective).
3. Training requirements.
4. Equipment, materials and vehicles.
5. Support (General Expenses and General Administration).

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CHAPTER 200 - FISH HABITAT ASSESSMENT

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CHAPTER 200 - FISH HABITAT ASSESSMENT

The fish habitat inventories contained within this chapter detail the procedures to use on Region 5 waters to assess fish habitat conditions. The survey is divided into four different steps with each step based on the intensity needed to address different levels of planning and activity needs. Sample forms are provided for Steps I and II in order to facilitate data collection.

210 - WATERSHED OVERVIEW.211 - Step I Process211.1 - Objectives. The objectives of Step I are to:

1. Provide basic information for land and resource management planning on large geographical areas.
2. Obtain general statistical information to respond to issues of State and Nation-wide concern.
3. Aid in planning for more intensive levels of survey.
4. Provide a nucleus for accumulation of historical data.

211.2 - Standards. Standards for the inventory relate to accuracy. Statistical accuracy is not definable, but directly relates to the scale and accuracy of base maps, photographs, and the human error introduced in measuring the material.

At a minimum, maps used should be as accurate as USGS 7.5 minute series quadrangles. Measurements should at least be made with a map wheel and dot grid. English or metric scale measurements are acceptable but should be consistent for all measurements. (Data bases and analysis routines must include automated data conversion coefficients.)

211.3 - Equipment Needed.

USGS 7 1/2 Minute Quad Maps/aerial photographs
Planimeter
Calculator
Watershed Codes (R-5 FSH 2509.24)
Step I Watershed Overview Form (exhibit 1, R5-2600-26)
Graph Paper

211.4 - Procedure. This step is office work. The R5-2600-26 is shown in exhibit 1 and is available electronically. Forests may create their own forms based on their needs but the information listed in exhibit 1, as a minimum, must be incorporated.

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Exhibit 1Data Entry Instructions: Step I Watershed Overview

- | <u>Item</u> | <u>Explanation</u> |
|--|--|
| 1. State | Enter appropriate code from list:
<u>06</u> California
<u>32</u> Nevada
<u>15</u> Hawaii |
| 2. County | Record county in which the stream is located. |
| 3. Forest | Enter appropriate code from list:
<div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 48%;"> 01 Angeles
 02 Cleveland
 03 Eldorado
 04 Inyo
 05 Klamath
 06 Lassen
 07 Los Padres
 08 Mendocino
 09 Modoc </div> <div style="width: 48%;"> 10 Six Rivers
 11 Plumas
 12 San Bernardino
 13 Sequoia
 14 Shasta-Trinity
 15 Sierra
 16 Stanislaus
 17 Tahoe
 19 Lake Tahoe Basin
 Management Unit </div> </div> |
| 4. District | Refer to Forest Service data general netlink documentation for district codes. |
| 5. Watershed Code
(National Locator Code) | Number streams in order to establish positive identification of individual waters for computer data files and for storage of survey data for later retrieval and manipulation into output programs. Use a sequential numbering system of a two- and three- digit series of numbers for streams, and use alpha-numeric combinations of numbers based on the drainage and tributary sequence. Regardless of the number of surface waters in the Pacific Southwest Region having the same name, the system will place each of the waters in a specific geographic location. For example, the catalog number of Jackass Creek on the Upper San Joaquin River is 18, 004, 000, 006, 010 because it is a tributary to the mainstem San Joaquin River, which is within the San Joaquin River basin, which is within the Pacific Southwest Region. Therefore, the catalog number for each of these streams would be: |

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 1 -- continued

18	California Region
18, 004	San Joaquin Basin
18, 004, 000	San Joaquin River
18, 004, 000, 006	Upper San Joaquin River
18, 004, 000, 006, 010	Jackass Creek

See R-5 FSH 2509.24 for the principal watershed codes for all forests. Forest Supervisors will assign numbers to remaining surface waters, including lakes.

[BLOCKS 6 THROUGH 13 REQUIRE USE OF A USGS 7-1/2 SERIES QUAD MAP THAT INCLUDES THE ENTIRE WATERSHED FOR THE STREAM. ASSEMBLY OF THE COMPLETE WATERSHED MAP MAY REQUIRE CUTTING AND PASTING TO QUAD SHEETS TOGETHER]

6. Stream Name Name of stream as it appears on USGS Quad and/or in forest catalog. Note any differences in stream names in the comments section.

7. USGS Map Enter the name of the USGS quadrangle containing the stream mouth. If two quad sheets are necessary to form a complete basin, indicate second quad name and which quarter of the quad (NW, NE, SW, or SE) was used.

8. Location Record longitude and latitude in degrees, minutes and nearest 5 seconds for the stream mouth or the point where the stream crosses the forest boundary. Use appropriate geodetic scale to interpolate precise longitude and latitude off of the USGS quad. Record township, range and section of the stream mouth or the point where the stream enters the forest boundary. Record section down to the quarter section.

9. Aerial Photos Enter the flight line(s), photo numbers and year for the sequence of photos that covers the entire basin.

10. Total Length Enter the length of the stream within the forest boundary by ownership: Federal, State, and other. Record to the nearest 0.1 mile. Use the "blue line" method to determine upper end of stream in this step. In this method, measure the main stream channel length by map wheel or digitizer to the end of the "blue line" drawn on the 7-1/2 minute USGS quad.

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Exhibit I -- continued

11. Stream Order Stream order describes the branching pattern of river systems. Record the stream order of the channel estimated for the stream mouth or at the forest boundary. Use the 7-1/2 minute USGS quad and the crenulation method to determine order. [The crenulation method utilizes the contours on a USGS QUAD. The definition of the source (beginning) of the stream channel is the point where there are no sharp crenulations (that is, bends) in the contour.] (Gregory, 1966)

Using a pencil, draw in the stream channels on the USGS map. To keep track, lightly write the order number next to the channel. The smallest unbranched tributary is a first order channel. When two first order streams join, the stream from that point downstream becomes a second order stream. Likewise, when two second order channels join, it becomes a third order channel and so forth (see figure 1).

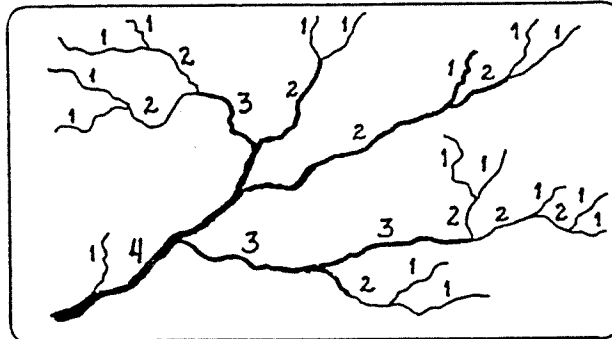


Figure 1 Stream Order Using the Crenulation Method

12. Watershed Area Compute total area in the watershed above the stream mouth or forest boundary to nearest 10th acre. Indicate amount within National Forest, other public ownership (State, or other Federal) and private. To obtain this measurement use a planimeter or dot grid. Draw the watershed boundary and land ownership boundaries in pencil on the USGS quad. [Note: Much of this work may have been completed for forest plans] Investigators should inquire of the Lands or Planning units prior to completing these blocks

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 1 -- continued

13. Lakes in Watershed Record number and acres (TO NEAREST ACRE) of lakes in the watershed.

[NOTE: ITEMS 14 AND 15 REQUIRE COORDINATION WITH WATERSHED OR TIMBER MANAGEMENT UNITS. DO NOT ATTEMPT TO CLASSIFY STREAMS OR CALCULATE ERA VALUES!]

14. R5 Stream Class Stream classes are a means of identifying resource values and beneficial uses associated with streams. See R-5 FSH 2509.22 for definitions. Investigators should inquire of the Watershed or Timber units prior to completing this block.
15. Cumulative Watershed Effects Record the percent of drainage affected by management activities based on Equivalent Road Acres. Investigators must get this value from the Forest Hydrologist. Refer to R-5 FSH 2509.22. [NOTE: FILL IN THIS BLOCK ONLY IF THE ERA PERCENTAGE HAS BEEN CALCULATED.]

[NOTE: ITEMS 16-18 REQUIRE COORDINATION WITH CALIFORNIA DEPARTMENT OF FISH AND GAME MANAGEMENT PERSONNEL].

16. State Management Record the management strategy from the following list, which best describes the California Department of Fish and Game direction for the stream. For some, there may be more than one.

Catchables: Stocking of fish grown in hatchery and stocked when reaching catchable size.

Basic Yield: Primarily provides fishermen with an opportunity to take catchable size fish from streams stocked with fry or fingerling from a hatchery. Fish are grown basically in the wild.

Trophy: Provides opportunity to catch larger than normal size fish.

Unique Species: Fish species (subspecies or races) with limited opportunity for fishermen.

Wild Trout: A trout fishery totally supported by natural production.

Not Classified: Streams not listed in this section.

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 1 -- continued

17. Fish Species Starting from the right, record the most dominant or important fish species, using the corresponding number from the following list of California freshwater fish. Up to five species can be listed.

Game and Nongame Fish

01-Pacific lamprey	37-Hardhead	88-California killifish
02-River lamprey	38-Hitch	89-Desert pupfish
03-Pacific brook lamprey	39-Sacramento squawfish	90-Owens pupfish
04-Pit-Klamath brook lamprey	43-Tui chub	91-Amargosa pupfish
05-White sturgeon	44-Arroyo chub	92-Salt Creek pupfish
06-Green sturgeon	48-California roach	93-Cottonball Marsh pupfish
09-American shad	49-Speckled dace	94-Mosquito fish
10-Threadfin shad	50-Lahontan redbreast	102-Mississippi silversides
11-Eulachon	51-Red shiner	103-Threespine stickleback
15-Mountain whitefish	52-Flathead minnow	104-Striped bass
16-Pink salmon	53-Bigmouth buffalo	105-White bass
17-Chum salmon	62-Staghorn sculpin	106-Sacramento perch
18-Coho salmon	63-Slender sculpin	107-Black crappie
19-Chinook salmon	64-Prickly sculpin	108-White crappie
20-Sockeye salmon	65-Marbled sculpin	109-Warmouth
21-Kokanee	66-Riffle sculpin	110-Green sunfish
22-Brook trout	68-Santa Ana sucker	111-Blue gill
23-Lake trout	69-Mountain sucker	112-Pumpkinseed
24-Interior Dolly Varden	71-Klamath smallscale sucker	113-Redear sunfish
25-Coast Dolly Varden	73-Tahoe sucker	114-Largemouth bass
26-Cutthroat trout	74-Owens sucker	115-Spotted bass
27-Brown trout	75-Klamath largescale sucker	116-Smallmouth bass
28-Redband trout	76-Sacramento sucker	118-Yellow perch
29-Golden trout	77-Blue catfish	123-Tule perch
30-Rainbow trout	78-Channel catfish	128-Sharpnose sculpin
31-Artic grayling	79-White catfish	129-Rough sculpin
32-Carp	80-Yellow bullhead	131-Pit sculpin
33-Goldfish	81-Brown bullhead	132-Paiute sculpin
34-Tench	82-Black bullhead	133-Reticulate sculpin
35-Golden shiner	83-Flathead catfish	
36-Sacramento blackfish	85-Rainwater killifish	

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 1 -- continued

18. Threatened, Endangered and Sensitive Species

Record all TES species using the endangered alphanumeric codes, for example, 1a or 3b and so forth, listed in the following:

1. Endangered (Federal)
 - a. Mohave tui chub
 - b. Owens tui chub
 - c. Unarmored three spined sticklback
 - d. Modoc sucker
 - e. Shortnose sucker
 - f. Lost River sucker
2. Threatened (Federal)
 - a. Paiute cutthroat trout
 - b. Little Kern golden trout
 - c. Lahontan cutthroat trout
3. Forest Service Sensitive (FSM 2670)
 - a. Summer steelhead
4. Endangered (State)
 - a. Bull trout
 - b. Razorback sucker
5. Threatened (State)
 - a. Cottonball March pupfish
 - b. Rough sculpin

19. Stream Flow Data Enter yes or no accordingly if streamflow data is available. Indicate where data is stored, that is, STORET (computer data base), State, Forest Service, USFWS or consultants reports. If in report format, record date, author and title.
20. Water Quality Data Enter yes or no. Indicate where data is stored (see 19. Record date, author and report title if in report format.
21. Macroinvertebrate Data Enter yes or no. Indicate where data is available. Record date, author and report title if in report format.
22. Major Land Uses in Drainage Record up to five land uses from the alphanumeric codes listed in the following:

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 1 -- continued

- | | |
|----------------------|-----------------------------|
| 1. Road development | 6. Water development(s) |
| a. Paved roads | a. Large hydro |
| b. Unpaved roads | b. Small hydro |
| 2. Timber harvest | c. Diversion |
| 3. Mining | 7. Developed recreation |
| a. Open pit | a. Ski areas |
| b. Hard rock | b. Campgrounds |
| c. Suction dredge | 8. Dispersed Recreation |
| 4. Livestock grazing | 9. Urbanization |
| 5. Wilderness | 10. Off-Highway Vehicle Use |

- | | |
|------------------------------|--|
| 23. Historical Land Use Data | Enter yes or no. Indicate where data is stored (for example, stand record cards). |
| 24. Comments | Enter all comments that clarify other items or that are important to describe the overall condition of aquatic resources in the watershed. |
| 25. Name | Enter last name and first initial of the individual completing the form. |
| 26. Date | Enter the numerical designation for month/day/year, left to right, for example, June 1, 1988 is 06-01-88. |

Data Entry Instructions for USGS Map: This information can be entered directly on to the USGS map.

- | | |
|------------------|--|
| 1. Channel Types | Using gross gradient breaks listed in the following USGS quad sheet contours, divide the stream channel into A, B and C channel segments. Use an arrow pointing downstream (<-->) to indicate the approximate end of the channel type. Clearly label each segment A, B, or C. Construct a longitudinal profile using graph paper to help determine the breaks. |
|------------------|--|

Channel Type Gradient Breaks

<2.0% = C channels

2.0 - 3.9% = B channels

>4.0% = A channels

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 1 -- continued

- | | |
|-------------------------------|--|
| 2. Landmarks/Access
Points | As clearly as possible, highlight landmarks, access points, special features and other items visible on the aerial photos but not shown on the USGS quad. This is particularly important if new roads, facilities or other developments have been constructed in the watershed since the last USGS update of the quad. |
|-------------------------------|--|

211.5 - Outputs. The Step I Watershed Overview data form provides a rapid summary of general watershed level information to examine prior to field work of any sort.

The USGS map is the general reference for more specific habitat assessment work.

Under cover of the Step I form and the USGS map, attach all pertinent historic information, including but not limited to, past Stream Survey data (R5-2600-16), Lake or Reservoir Survey data (R5-2600-17), Stream Crossing Structures and Evaluation Inventory data (R5-2600-18), and CDF&G stream survey reports or fish sampling data.

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USDA - Forest Service

R5-2600-26 (12/91)

WATERSHED OVERVIEW

(Step I)

(Ref: FSH 2609.23)

1. State _ _ 2. County _ _ _ _ 3. Forest _ _ _ 4. District _ _
5. Catalog No. _ _ _ _ _
6. Stream Name _ _ _ _ _ 7. USGS Quad _ _ _ _ _
8. Location: Longitude _ _ _ _ Latitude _ _ _ _
Twn. _ _ Rng. _ _ Sec. _ _
9. Aerial Photos (FL & nos., yr) _ _ _ _ _
10. Total Length _ _ . _ miles USFS _ _ . _ , Other Federal _ _ . _ ,
State _ _ . _ Pvt. _ _ . _
11. Stream Order _ _ 12. Watershed Area (acres): USFS _ _ _ _ . _
Other public _ _ _ _ . _ , Pvt. _ _ _ _ . _
13. Lakes in Watershed: Number _ _ _ Area (acres) _ _ _ . _
14. R5 Stream Class: _ _ _ 15. Cumulative Watershed Effects _ _ _ (%) E.R.A. _ _ _
16. State Management Concepts: Catchables _ Basic Yield _ Wild Trout _
Trophy _ Unique Species _ Not Classified _
17. Fish Species _ _ , _ _ , _ _ , _ _ , _ _ (Record up to 5 codes)
18. Threatened, Endangered or Sensitive Species _ _ , _ _ , _ _ , _ _ , _ _ , _ _
19. Stream Flow Data: _ _ _ _ _
20. Water Quality Data: _ _ _ _ _
21. Macroinvertebrate Data: _ _ _ _ _
22. Major Land Uses in Drainage _ _ , _ _ , _ _ , _ _ , _ _ (Up to 5 codes)
23. Historical Land Use Data: _ _ _ _ _
_ _ _ _ _
_ _ _ _ _
24. Comments: _ _ _ _ _
_ _ _ _ _
_ _ _ _ _
25. Investigators _ _ _ _ _ 26. Date _ _ / _ _ / _ _

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220 - STEP II HABITAT INVENTORY--QUALITY AND QUANTITY.221 - Step I Process.

221.1 - Objective. Step II is the basic habitat inventory for determining the quality and quantity of fish habitat. The objective of Step II is to provide information necessary to develop a sound habitat program, including land management recommendations and habitat restoration and improvement projects.

221.2 - Standards. Specific standards for the procedure to accomplish Step II are listed in the following:

1. Determine selected morphological characteristics of stream channels for watersheds on National Forest System and adjacent lands. The aggregation of these characters must follow the "channel type" delineations adapted from Rosgen's channel typing system. (Exhibit 2)
2. Systematically classify and quantify fish habitat for complete watersheds, using standard habitat types found in McCain et al., 1990. (Exhibit 3)
3. Collect biological data using sampling techniques that describe species composition, age class, and relative numbers for individual habitat types. (Exhibit 4)
4. (Optional) Identify vegetative community typing and relative abundance of streamside (riparian) and aquatic vegetation as a link to the ecological classification system. Data collection can follow the format on Channel Analysis Sample Form. See FSH 2090.11 for full ecosystem classification format.

221.3 - Equipment Needed. The following is a list of equipment needed to perform basic habitat inventory:

Step II sample forms as appropriate.
 USGS Quads and aerial photographs
 Abney level
 Hand level and stadia rod (for measuring gradients and depth)
 Spherical densiometer
 Camera
 Current meter
 Measuring devices
 Flagging or tagging material
 Sturdy stream boots, wading gear.
 Snorkel gear, wet suit or dry suit
 Thermometer

221.4 - Procedure. There are three phases needed to complete Step II: (1) preplanning before starting field work; (2) field measurements (Exhibit 2, 3 & 4), and (3) office work (data analysis).

FISHERIES HABITAT EVALUATION HANDBOOK

221.5 - Preplanning. Prior to entering the field, determine equipment and information needs. Field crews and forest stream habitat assessment supervisors shall agree on amount of stream to cover daily. This can be adjusted based on various field and personnel constraints. Outfit field crews according to the Job Hazard Analysis form FS-6700-7. Brief field crews periodically over the length of the assessment period, using the Tail Gate Safety session concept to review field hazards and check equipment.

Using the USGS Quads completed at Step I and aerial photos, field crew leaders or Forest stream habitat assessment supervisors shall determine the following standard mapping conventions:

1. Preliminary channel types and approximate channel type beginning and ending points.

2. Identification of unnamed tributaries of main channels.

- a. Channel types are lengths of stream channel with relatively uniform channel morphological features. Determine channel types in the field. However, make preliminary channel delineations (either A, B or C) by using channel gradient breaks determined by developing the longitudinal profile required in Step I. Indicate the downstream extent of a channel type on the field map with an <- pointing in the downstream direction.

A reach cannot be longer than the length of a channel type. However, when the channel type extends over great distances it may be necessary to subdivide the channel type length into shorter defined reaches in order to obtain a more detailed channel analysis. The numbering convention should be standard with the first reach in a watershed being at the stream mouth or forest boundary.

- b. After surveying unnamed tributaries assign an alphabetic delineation according to their location in the watershed. Designate the tributary nearest the stream mouth "trib a". Assign the next letter of the alphabet to each tributary entering the main channel upstream of the initial tributary. (If surveying more than 26 tributaries in a drainage, assign "aa", "bb", and so forth). Tributary channel types and reaches begin at the confluence with the main channel and numbered consecutively using the same standard conventions as the main channel reach numbering: "trib a, #1" designates the first reach in the first tributary.

FISHERIES HABITAT EVALUATION HANDBOOK

221.6 - Field Sampling. This is the minimum amount of data to collect for Step II. Flexibility is built in by allowing the biologist/hydrologist to add information and increase the sampling schemes based on individual forest needs and objectives. These forms are electronically filed in the forms library. The forms provided serve as examples only and can be used by the forest to create their own forest forms. However, the information listed on the optional forms must be incorporated into the forest forms. Work with your forest forms manager to make necessary changes. The forms are listed as:

- R5-2600-27 (12/91) - Channel Analysis
- R5-2600-28 (12/91) - Habitat Typing Form
- R5-2600-29 (12/91) - Biological Inventory

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 2Channel Analysis

A. This information is gathered once for each channel type (or sub-divided reach, as previously outlined.)

<u>Item</u>	<u>Explanation</u>
1. NO. __OF__	Print in the sequential number of the form, beginning with "1" on the first set of the forms, "2" on the second set and so on. Record data on this form once for each stream reach. When all forms for a channel type are complete, add total number on each form behind "of".
2. Date	Enter the day's date in the form mm/dd/yy.
3. Stream	Print in the stream's name first, followed by the name of the drainage.
4. Forest and District	Enter name of forest and the ranger district on which the stream is located.
5. Stream Locator Code	Record watershed locator code as described in Step I. Place the number to the far left and leave the remaining spaces blank.
6. Aerial Photo	Enter the flight line, photo number and year of aerial photos in which the stream reach occurs.
7. USGS Quad	Enter the name of the USGS quadrangle containing the reach.
8. State	Record appropriate code for State in which stream is located.
9. County	Record county in which the section of the stream being surveyed is located.

(RECORD ITEMS 10 THROUGH 16 AT THE BEGINNING OF A DESIGNATED REACH.)

10. Reach Number	Record the number assigned at the preplanning stage beginning with 1 for the lowermost stream reach in the basin.
11. Elevation	Record the elevation to the nearest 0.1 M above sea level, using a pocket altimeter.

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 2 -- continued

12. Access Enter the dominant access to the reach.
1. Access is satisfactory for modern car.
 2. Access if appropriate for pickup.
 3. Access is appropriate for 4-wheel drive.
 4. Access trail for horse or foot travel.
 5. No trail to area.
13. Road Number Record nearest road number from quad.
14. Location Record the latitude and longitude to the nearest minute and township, range and section at the beginning of each reach. Latitude and longitude should be extrapolated from USGS quads. Sections should be recorded as NW, NE, SW, or SE 1/4 of the section.
15. Flow Regime Enter ephemeral, intermittent, or perennial.
16. Flow Measurement Record the flow volume at time of survey to the nearest 0.1 cubic meter per second (cms) or nearest 0.1 cubic feet per second (cfs). Utilize a representative site with laminar flow. Stretch a tape across the channel and take a minimum of 4 depth and velocity measurements. Flow is determined by multiplying average depth by width by velocity. Take as many readings as practical using one of the following meters. In difficult access areas the float method is acceptable.
17. Type of Flow Meter Record code for meter type used.
1. Pygmy Meter
 2. Price Meter
 3. Electromagnetic Current Meter
 4. Other

(RECORD ITEMS 18 THROUGH 25 OVER THE LENGTH OF A DESIGNATED STREAM REACH.)

18. Average Gradient Record stream gradient to the nearest 0.5 percent using a hand level and rod, as a minimum. Take gradients over 100 M (300 Ft.) lengths or over the visible distance if between channel bends or in heavy vegetation, and averaged over the reach. Do not include measurements beyond the gradient breaks used to define end points for channel types.

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 2 -- continued

19. Channel Type Print in channel type using the system adapted from Rosgen stream channel classification system.
20. Reach Length Record total length of stream reach.
21. Habitat Inventory This procedure is part of the Channel Analysis but has a separate data collection form for all habitat types within the channel type reach. See Exhibit 3 for instructions. On the Channel Analysis data sheet, fill in the form numbers from the Habitat Typing Form. (For example, form numbers 15-22)
22. Other Forms/
Inventories Reference any other inventories completed for this reach, (for example, WINI, Channel Stability, Ecosystem Mapping) and indicate their location.
23. Riparian Inventory (Optional) A riparian ecosystem is a transition between the aquatic ecosystem and the adjacent terrestrial ecosystem and is identified by soil characteristics and distinctive vegetation communities that require free or unbound water. Take this inventory at a site(s) representative of predominant riparian character within the reach.
- a. Ecosystem Code - (Reserved for future use.)
Do not fill in a code unless available from a preliminary or final ecosystem classification data base.
- b. Width - Record an estimated total width for the riparian zone including the stream channel. Make the estimate by summing individual distance estimates viewed from the left and right edge of the water. (If you cannot obtain a clear field of view from the water's edge, move to a spot on the bank where you can make a visual estimate can be made and add the distance to the water's edge.)
- c. Vegetation Layers - Enter the percent of the total of each class observed in the riparian zone. The percentage should equal 100% for each layer. Utilize the following definitions:

Upper - the overstory layer, generally composed of trees.

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 2 -- continued

CONIFER - evergreen trees that generally produce cones, for example, pines, firs, redwoods.

HARDWOOD - broad leafed trees that loose leaves in fall/winter period, for example, alders, aspen and maple.

OTHER - trees that do not fall into the above two categories, for example, Joshua trees.

Middle - middle tier. When the overstory is not predominant, it may form primary shade canopy.

SHRUBS - plants with woody stems and generally profuse foliage, for example, willows, young alder, devil's club or vine maple

BRUSH - plants with woody stems, spindly and with generally sparse vegetation, for example, sagebrush, chaparral, chemise, salmonberry

OTHER - woody plants that do not fall into the above two categories.

Lower - herbaceous ground cover ranging from grasses to bare soil.

d. Nondependent Riparian Use Levels - Enter the usage codes appropriate for the stream reach from the following list:

0 = None	2 = Moderate
1 = Low	3 = High

24. Team

Record first initial and last name of each member of the team.

25. Comments

Add comments that help to clarify observations made on the form or that are important to help understand observations about aquatic resources. Note any photographs (use roll and photo number format) taken of general reach conditions, riparian areas, or habitat improvement opportunity sites.

FISHERIES HABITAT EVALUATION HANDBOOK

USDA - Forest Service

R5-2600-27 (12/91)

CHANNEL ANALYSIS
(Step II)
(Ref: FSH 2609.23)

1. Form # _____ of _____

2. Date _ _ / _ _ / _ _

3. Stream _____ 4. Forest/District _____

5. Locator Code _____ 6. Air Photo (FL,#,yr) _____

7. USGS Quad _____ 8. State _____ 9. County _____

[DATA TAKEN AT BEGINNING OF REACH]

10. Reach # _____ 11. Elevation _____ 12. Access _____ 13. Road # _____

14. Location: Lat _____ Long _____ T _____ R _____ S _____

15. Flow Regime _____ 16. Flow Measurement _____ (cms/cfs) 17. Method _____

[DATA TAKEN OVER THE REACH]

18. Average Gradient _____ 19. Channel Type _____ 20. Reach Length _____

21. Habitat Inventory: Form #'s _____

22. Other Forms/Inventories (Optional) Cross Reference _____

23. Riparian Inventory (Optional):

a. Ecosystem Code _____ (Ref. FSH 2090.11)

b. Average Width _____

c. Vegetation Layers (total observed within reach)

Upper: CONIFER _____ % HARDWOOD _____ % OTHER (_____) _____ %Middle: SHRUBS _____ % BRUSH _____ % OTHER (_____) _____ %Lower: GRASSES _____ % FORBS _____ % LITTER _____ %

ROCK _____ % BARE SOIL _____ %

d. Nondependent Riparian Use Levels (% observed within reach)

ROAD _____ GRAZING _____ MINING _____ DEVELOPED REC _____

DISPERSED REC _____ TRAIL _____ TIMBER HARVEST _____

OFF HWY. VEHICLE _____ OTHER (TYPE) _____

24. TEAM _____ 25. COMMENTS _____

FISHERIES HABITAT EVALUATION HANDBOOK

EXHIBIT 3

Habitat Inventory

Fill out the form for all habitat units within a channel type or sub-divided reach. In most cases, more than one form is necessary.

1. Stream Name Enter name of stream as listed on USGS Quads.
2. Form number If more than one Habitat Typing Form is filled out for a reach, use the format Form# __ of __ to indicate total forms used for that stream.
3. Date Enter the day's date in the form mm/dd/yy.
4. Channel Type Print in the channel type. Begin a new series of Habitat Inventory forms for each channel type.
5. Reach Number Enter the reach number beginning with 1 for lower-most reach in the basin.
6. Field Photo Record roll identifier and photo number of habitat type pictures taken in the field. Black and white prints or color slides are acceptable. Field crews should attempt to record both upstream and downstream view of habitat types. It is recommended that a crewmember, measuring rod or some other item of known dimensions be included in the picture to denote scale and direction of flow. A photo record of at least one of each different habitat types within a reach can be made.
7. Habitat Type Information Fill out the form for all habitat units within a stream reach. Start a new page for each new channel type.
 - a. Habitat Unit # Number habitat units sequentially, beginning with #1 from the mouth or Forest boundry.
 - b. Habitat Unit Type Enter the number for the habitat type from the range of habitat types in McCain et. al. 1990. Record only dominant habitat types, that is those that are longer than one width of the wetted channel. The one exception to this is if the Habitat Type is significant (that is, a short riffle separating two distinct pools.).

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 3 -- continued

- c. Side Channel Unit Number When numbering side channels, parallel or adjacent units, begin with the number of the unit where the downstream split or divide begins, use a new column for each adjacent unit. The side channel would be numbered "_.1". If there was a second side channel in the same unit it would be numbered "_.2" and so on. For side channels containing more than one habitat type, units are numbered "_.11", "_.12", "_.13" and so on. See example below:

HABITAT UNIT #	10		11				
HABITAT UNIT TYPE	1	1	13	2	1	2	1
SIDE CHANNEL UNIT		10.1		11.1	11.21	11.22	11.23

This example shows habitat unit 11 having two side channels or adjacent units with the second, 11.2, having three habitat units in it. Draw picture to clarify.

- d. Length Enter the length for each habitat type.
- e. Mean Width Enter the mean width for each habitat type.
- f. Mean Depth Enter the measured mean depth for each habitat type unit.
- g. Max Depth Enter the measured maximum depth for each habitat type unit.
- h. Dp @ Pool Tail Crest. Enter the measured depth at the pool tail crest. This location is usually upstream of the point where the water surface slope breaks into the riffle. Use this measurement in calculating residual pool volume.
- i. Stream Shade Enter the % canopy closure or density using spherical densiometer and following the technique outlined in Platts et. al., 1987. Record stream shade reading for each habitat type per sampling scheme (for example, sample every unit or a 20% sample size of each habitat type).

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 3 -- continued

- j. Instream Cover Enter the visually estimated percent of the total wetted habitat type area that has cover. Classify cover by types indicated on the form. Note: SWD = small woody debris, LWD = large woody debris, and RW = rootwads. Include terrestrial vegetation within .3M above water. White water includes bubble curtains formed by plunge pools.
- k. Cover Complexity For all pools enter 1(low), 2(low-medium), 3 (medium), 4 (med-high), or 5 (high) for the complexity rating of cover. Consider availability to fish, using surface area and degree of submersion as your guides; for example, a root wad is more complex than a log, but only if submerged.
- l. Substrate
Composition Enter the percent of the total unit bottom that each substrate size class occupies, per sampling scheme.
- m. Substrate
Embeddedness In pool tails and low gradient riffles, enter the percent that the substrate is embedded. (Embeddedness here refers to the visually derived percentage of filling in the interstitial spaces around gravel or cobble substrate.)
- n. Exposed Substrate In riffles, enter the percent of the stream area that consists of substrate exposed above the water surface.
- o. Time-Temperature In every fifth habitat type enter the time of day in military time and record the temperature in centigrade.
- p. Comments Enter any comments that will aid the biologist/hydrologist in identifying that site, that is, road crossings, artificial structures-weirs, deflectors, boulders, slides, distinctive geomorphological observations and biological observations. If using a computer database system that allows querying of comments crews can use certain "buzz words" (for example, trib; artificial; slide; and so on), to assist the biologist in finding specific sites.

FISHERIES HABITAT EVALUATION HANDBOOK

USDA - Forest Service

R5-2600-28 (12/91)

HABITAT TYPING FORM

(Step II)

(Ref: FSH 2609.23)

1. Stream Name _____ 2. Form # _____ of _____

3. Date ____/____/____ 4. Channel Type _____ 5. Reach # _____

6. Field Photo: Roll _____ # _____ # _____ # _____ # _____ # _____ # _____ # _____

Measurements in units of: METERS _____ FEET _____ (1/10THS) _____ (1/12THS) _____

a.HABITAT UNIT #									
b.HABITAT UNIT TYPE									
c.SIDE CHANNEL UNIT #									
d.LENGTH									
e.MEAN WIDTH									
f.MEAN DEPTH									
g.MAX DEPTH									
h.Dp @ POOL TAIL CREST									
i.STREAM SHADE %									

j.INSTREAM COVER XXX

Total	%								
undercut banks	%								
swd (d<0.3M)	%								
lwd (d>0.3M,RW)	%								
terr.vegt. (h<0.3M)	%								
aqua.vegt.	%								
white water	%								
boulders (d>30CM)	%								
bedrock ledges	%								

k.COVER COMPLEXITY

l.SUBSTRATE COMPOSITION *****

bedrock	%								
boulder (>30cm)	%								
cobble (>8-30cm)	%								
gravel (>0.5-8cm)	%								
sand (1mm-0.5cm)	%								
finer (<1mm)	%								

m.POOLTAIL EMBEDDEDNESS%

n.EXPOSED SUBSTRATE %

o.TIME-TEMPERATURE - XXXXXXXXXXXXXXXXXXXX - XXXXXXXXXXXX

(every 5th unit) *****

p.COMMENTS

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 4

B. BIOLOGICAL INVENTORY - Refer to R5-2600-29 . Record the following for habitat sites to be inventoried as decided by the fish biologist. Make decisions on type of sampling equipment, sampling frequency and objectives of sampling before entering the field (see D. Azuma, 1990 "Generic Aquatic Resource Monitoring" for information in establishing a biological inventory scheme). Obtain a valid Scientific Sampling Permit from the California Department of Fish and Game Regional Office prior to sampling by electrofisher, nets or other removal methods. Notify local CDF&G fisheries biologists or wardens prior to each sampling event, regardless of method.

- | | |
|-----------------------------|--|
| 1. Reach Number | Record the sequential number of the sampled stream reach. (This number should be the same as item 10. Reach # on the Channel Analysis Form.) |
| 2. Form # | Enter the form number as 1 of "x", 2 of "x", and so forth, where "x" is the total number of forms completed for the reach. |
| 3. Date | Record the day's date as mm/dd/yy. |
| 4. Stream Name | Record the stream name as listed on the USGS Quad. |
| 5. USGS Quad | Enter the name of the USGS 7.5 minute series quadrangle containing the stream. |
| 6. Location | Enter latitude and longitude to the nearest minute for the site. Enter township, range, and section location at the beginning of the stream reach. |
| 7. Habitat Type
Unit | Enter the number or abbreviation for the sampled individual habitat type. The number/abbreviation should correspond to item 22. a. HABITAT UNIT TYPE on the Habitat Typing Form. |
| 8. Mean Length | Record the visually estimated/measured mean length for each habitat type. |
| 9. Mean Width | Record the visually estimated/measured mean width for each habitat type. |
| 10. Mean Depth | Enter the measured mean depth on each habitat type unit. |
| 11. Maximum Depth | Enter the maximum depth for each habitat type unit. |
| 12. Depth @ Riffle
Crest | Enter the measured depth at the riffle crest. |

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 4 -- continued

- | | |
|-------------------------------|---|
| 13. % Shade | Enter the % canopy closure or density using the spherical densiometer and following the technique outlined in Platts et. al., 1987. |
| 14. % Embeddedness | Enter the percent of substrate surface covered by sediment. |
| 15. Exposed Substrate | Enter the percent of the stream area that consists of substrate exposed above the water surface. |
| 16. Substrate Composition | Enter the percent of the total unit bottom that each substrate size class occupies. |
| 17. Instream Cover | Enter the percent of the area of the unit in which cover physically occupies. Classify cover by types indicated. Note: SWD=small woody debris, LWD=large woody debris (includes root wads), white water includes bubble curtains. Include terrestrial vegetation within .3M above the stream. Indicate whether or not depth is a significant component and enter Y or N |
| 18. Complexity | Enter 1(low), 2(low-medium), 3(medium), 4(medium-high), or 5(high) for the complexity rating of cover. Consider availability to fish, using surface area and degree of submersion as guides; that is, a root wad is more complex than a log, but only if embedded. Consider depth as a component and adjust rating accordingly. |
| 19. Aquatic Vertebrate Survey | Record water temperature to nearest degree centigrade, time of day in military time and cloud cover(cloudy, partly cloudy or clear). Record fish species, age group, and numbers sampled or observed. Circle the sampling method used in the survey. |
| 20. Comments | Record comments regarding any of the above observations. Use this section to record photographs using roll identifier and photo number format. Photos may be black and white prints or color slides and may include examples of habitat type units, fish species or sampling activities. |
| 21. Team | Record the first initial and last name of each investigator on the team. |

FISHERIES HABITAT EVALUATION HANDBOOK

USDA - Forest Service

R5-2600-29 (12/91)

BIOLOGICAL INVENTORY

(Step II)

(Ref: FSH 2609.23)

1. Reach # _____ 2. Form # _____ of _____

3. Date ____/____/____

4. Stream Name _____ 5. USGS Quad _____

6. Location: Lat _____ Long _____ Twn _____ Rng _____ Sec _____

7. Habitat Type Unit _____ 8. Mean Length _____ 9. Mean Width _____

10. Mean Depth _____ 11. Max Depth _____ 12. Depth @ Riffle Crest _____

13. % Shade _____ 14. % Embeddedness _____ 15. % Exposed Sub. _____

16. Substrate Composition:

a. _____% b. _____% c. _____% d. _____% e. _____% f. _____%
fines <1mm sand gravel cobble boulder bedrock

17. Instream Cover: Total Percent Cover _____

a) _____ b) _____ c) _____ d) _____ e) _____ f) _____ g) _____ h) _____
undercut swd lwd terr.vegt aquatic white boulders bedrock
banks d<0.3M d>.3M,RW h<.3M vegt water d>30cm ledges

i) Depth _____

18. Complexity _____

19. Aquatic Vertebrate Survey

Water Temp _____			Time _____ PST OR DST			Cloud Cover _____		
Species	Age		*	Age		*	Age	
Class	Numbers		Species	Class	Numbers	Species	Class	Numbers
			*			*		
			*			*		
			*			*		
			*			*		
			*			*		
			*			*		
			*			*		
			*			*		

Method: Seine _____ Snorkel _____ Visual _____ Electroshocker _____

20. Comments: _____

21. Team: _____

FISHERIES HABITAT EVALUATION HANDBOOK

221.7 - Outputs. Development of summary tables and graphs for comparison and analysis of physical data. Query data to display and print by habitat type. Generate counts of number of units measured, as well as sums and averages for physical parameters (See Exhibit 5 for example outputs): The summarized data is then used to develop graphs and charts to display habitat type frequencies and distribution by length, area or percentage. Data queries can also be developed to display habitat sequences or areas of low or high habitat diversity.

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 5

BLUFF CREEK		ORLEANS R.D.			SIX RIVERS NATIONAL FOREST				COUNTY: SISKIYOU, DEL NORTH. HUMBOLDT					
TABLE 1A - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS (IN METERS)					SURVEY DATES: 6/21/88 - 8/17/88									
CONFLUENCE: T.10N., R.5E., SEC.30					WATERSHED CODE: 018-001-002-009-006					USGS QUADS: WHITCHPEC, FISH LAKE, LONESOME				
UNITS MEASURED	HABITAT TYPE	MEAN LENGTH M.	TOTAL LENGTH M.	% TOTAL LENGTH	MEAN WIDTH M.	MEAN DEPTH M.	MAXIMUM DEPTH M.	MEAN AREA SQ.M.	TOTAL AREA SQ.M.	MEAN VOL. CU.M.	TOTAL VOL. CU.M.	MEAN RESID. POOL VOL. CU. M.		
214	1	88.42	18921.64	51.31	6.80	0.34	0.63	680.5	145617.3	267.2	57177.4	0.0		
64	2	41.45	2652.06	7.19	8.59	0.46	0.80	362.4	23193.4	175.0	11199.6	0.0		
39	3	76.38	2978.39	8.08	9.72	0.64	1.24	751.7	29317.6	501.5	19559.4	0.0		
5	4	31.76	158.85	0.43	3.41	0.43	0.70	118.6	592.9	37.5	187.3	5.8		
25	5	9.72	242.85	0.66	4.30	0.46	0.80	41.7	1042.5	20.7	516.6	7.9		
3	6	6.61	19.81	0.05	3.38	0.52	0.93	21.7	65.2	12.1	36.2	11.6		
18	7	8.66	155.65	0.42	3.99	0.43	0.78	37.4	672.8	15.8	284.5	13.7		
15	8	22.37	335.63	0.91	6.67	0.98	2.13	160.8	2411.6	193.0	2894.9	333.0		
37	9	16.61	615.03	1.67	6.89	0.67	1.16	126.1	4664.4	92.7	3429.7	105.9		
19	10	16.40	311.43	0.84	5.12	0.52	0.87	91.1	1731.3	46.2	877.5	52.1		
11	11	13.72	150.99	0.41	4.48	0.43	0.79	58.3	641.7	25.1	275.6	32.0		
82	12	20.02	1642.64	4.45	5.67	0.64	1.26	122.7	10063.1	85.8	7033.0	128.9		
10	13	15.06	150.59	0.41	4.72	0.70	1.30	78.5	784.6	57.5	574.9	84.3		
15	14	15.45	231.70	0.63	8.59	0.40	0.56	150.9	2262.9	70.6	1059.4	0.0		
42	15	52.64	2210.88	5.99	7.38	0.43	0.78	422.6	17749.3	179.0	7518.5	0.0		
31	16	102.62	3181.01	8.63	9.36	0.55	1.16	966.0	29947.1	582.9	18069.3	0.0		
60	17	29.32	1758.76	4.77	7.53	0.82	1.70	247.2	14834.6	249.6	14978.9	317.1		
9	18	19.63	176.53	0.48	4.45	0.30	0.46	80.4	723.4	24.1	216.9	0.0		
4	19	14.57	58.31	0.16	6.86	0.91	1.53	96.0	383.9	82.9	331.7	118.3		
33	20	18.96	625.97	1.70	7.89	0.70	1.49	159.1	5251.5	126.1	4161.8	183.0		
5	21	57.91	289.48	0.78	7.13	0.30	0.48	349.8	1748.9	112.9	564.7	0.0		
1	22	11.09	11.09	0.03	6.49	0.76	1.30	72.0	72.0	54.9	54.9	76.2		
TOTAL UNITS MEASURED= 742		TOTAL LENGTH 36879.31 METERS			TOTAL AREA 293771.80 SQ. METERS 72.60 ACRES									

Summary of habitat types and measured parameters (in meters).

FISHERIES HABITAT EVALUATION HANDBOOK

Exhibit 5 - continued

BLUFF CREEK		ORLEANS R.D.		SIX RIVERS NATIONAL FOREST		COUNTY: SISKIYOU, DEL NORTE, HUMBOLDT					
TABLE 1B - SUMMARY OF HABITAT TYPES AND ESTIMATED PARAMETERS											
CONFLUENCE: T.10N., R.5E., SEC.30				WATERSHED CODE: 018-001-002-009-006				SURVEY DATES: 6/21/88 - 8/17/88			
USGS QUADS: WEITCHPEC, FISH LAKE, LONESOME RIDGE											
UNITS MEASURED	HABITAT TYPE	MEAN PERCENT COVER	MEAN % EXPOSED SUBSTRATE	MEAN PERCENT SHADE	MEAN SUBSTRATE EMBEDDEDNESS	MEAN PERCENT FINES	MEAN PERCENT SAND	MEAN PERCENT GRAVEL	MEAN PERCENT COBBLE	MEAN PERCENT BOULDER	MEAN PERCENT BEDROCK
53	1	13	15	29	10	1	11	22	41	19	6
21	2	5	16	21	17	1	11	15	38	29	7
13	3	4	18	13	30	1	9	11	29	37	13
2	4	29	8	19	3	3	40	20	25	13	0
9	5	30	16	31	4	1	19	19	41	19	1
1	6	57	0	58	5	5	20	30	45	0	0
4	7	51	0	64	6	1	30	36	31	1	0
1	8	22	5	53	65	0	10	10	10	5	65
13	9	49	8	35	17	1	12	19	42	20	7
3	10	38	3	55	8	3	8	28	45	13	2
4	11	40	5	52	13	8	16	38	36	3	0
17	12	29	7	41	11	2	21	24	29	14	10
2	13	59	0	60	5	3	20	35	40	3	0
6	14	0	3	45	4	1	16	31	40	8	4
8	15	3	6	30	4	0	12	24	50	13	1
8	16	2	19	13	18	1	13	16	36	26	9
14	17	24	4	31	11	1	25	27	30	10	7
6	18	21	8	33	3	7	23	28	26	10	6
2	19	35	5	25	8	0	15	25	38	23	0
7	20	29	16	26	16	1	20	21	29	23	6
4	21	38	38	37	9	3	14	26	26	30	0
1	22	40	0	60	10	0	20	45	35	0	0

TOTAL UNITS
MEASURED= 199

Summary of habitat types and estimated parameters.

BLUFF CREEK		ORLEANS R.D.				SIX RIVERS NATIONAL FOREST				COUNTY: HUMBOLDT, DEL NORTE, SISKIYOU					
BIOLOGICAL SUMMARY TABLE A - MEAN NUMBER OF FISH PER HABITAT TYPE (DIRECT OBSERVATION)								SURVEY DATES: 7/24/89 -8/23/89							
CONFLUENCE: T.10N., R.5E., SEC.30				WATERSHED CODE: 018-001-002-009-006				USGS QUADS: WEITCHPEC, FISH LAKE, LONESOME RIDGE							
UNITS SAMPLED	HABITAT TYPE	MEAN NUMBER OF FISH OBSERVED PER HABITAT TYPE						PARAMETERS MEASURED IN METRIC UNITS							
		0+ STEELHEAD	1+ STEELHEAD	2+ STEELHEAD	SUMMER STEELHEAD	0+ CHINOOK	0+ COHO	MEAN AREA SQ. M.	TOTAL AREA SQ. M.	MEAN LENGTH M.	MEAN WIDTH M.	MEAN DEPTH M.	MAXIMUM DEPTH M.	PERCENT COVER	PERCENT SHADE
33	1	48.15	5.61	1.12	0.03	0.03	0.00	247.65	8172.41	30.72	8.11	0.30	0.55	50	43
14	2	14.79	4.86	0.93	0.07	0.36	0.00	174.82	2447.41	17.68	9.45	0.46	0.79	44	76
5	3	7.80	4.00	0.60	0.00	0.00	0.00	164.40	822.02	17.49	9.63	0.61	1.01	43	90
1	8	8.00	0.00	0.00	0.00	0.00	0.00	20.07	20.07	8.23	2.44	1.22	1.89	50	43
9	9	15.33	11.89	1.56	0.11	0.11	0.00	134.33	1209.01	12.25	10.94	1.01	1.43	50	47
13	12	52.69	4.69	1.00	0.00	0.00	0.00	187.35	2435.49	22.83	7.80	0.76	1.43	61	26
2	13	40.00	8.50	2.00	0.00	0.00	0.00	101.95	203.90	11.89	8.69	1.01	1.74	53	88
10	14	64.80	4.90	0.70	0.10	2.00	0.00	402.61	4026.10	34.01	11.64	0.46	0.85	52	17
34	15	46.00	7.56	1.53	0.06	1.00	0.06	216.15	7349.15	24.87	8.44	0.55	0.85	49	29
23	16	52.09	22.52	3.17	0.17	2.48	0.00	404.34	9299.77	39.41	10.18	0.55	0.91	40	51
24	17	39.13	9.33	1.50	0.46	4.04	0.54	183.71	4409.01	21.00	8.50	0.88	1.49	54	32
12	20	27.58	5.42	1.33	0.25	0.08	0.00	187.13	2245.65	16.64	11.55	0.76	1.49	45	33

TOTAL UNITS SAMPLED= 180	0+ STEELHEAD	1+ STEELHEAD	2+ STEELHEAD	SUMMER STEELHEAD	0+ CHINOOK	0+ COHO	TOTAL AREA SAMPLED= 42639.98 SQ. METERS	TOTAL LENGTH SAMPLED= 4583.66 METERS
	7426	1571	268	24	216	15		

Mean number of fish per habitat type based on 20% sample size using direct observation methods.

R-5 FSH AMEND 1 EFFECTIVE 7/14/92

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Exhibit 5 - continued

BLUFF CREEK		ORLEANS R.D.				SIX RIVERS NATIONAL FOREST				COUNTY: HUMBOLDT, DEL NORTE, SISKIYOU										
BIOLOGICAL SUMMARY TABLE B - FISH NUMBERS AND DENSITIES PER HABITAT TYPE (AREA IN SQ. METERS)												SURVEY DATES: 7/24/89 -8/23/89								
CONFLUENCE: T.10N., R.5E., SEC.30						WATERSHED CODE: 018-001-002-009-006						USGS QUADS: WITCHPEC, FISH LAKE, LONESOME RIDGE								
UNITS MEASURED	HABITAT TYPE	NUMBERS OF FISH PER HABITAT TYPE										FISH DENSITY PER HABITAT AREA (FISH/Sq.M.)								
		MEAN 0+ STEELHEAD	TOTAL 0+ STEELHEAD	MEAN 1+ STEELHEAD	TOTAL 1+ STEELHEAD	MEAN 2+ STEELHEAD	TOTAL 2+ STEELHEAD	MEAN 0+ CHINOOK	TOTAL 0+ CHINOOK	MEAN 0+ COHO	TOTAL 0+ COHO	0+ STEELHEAD	1+ STEELHEAD	2+ STEELHEAD	0+ CHINOOK	0+ COHO				
33	1	48.15	1589	5.61	185	1.12	37	0.03	1	0.00	0	0.25190	0.02193	0.00344	0.00014	0.00000				
14	2	14.79	207	4.86	68	0.93	13	0.36	5	0.00	0	0.09139	0.03018	0.00463	0.00276	0.00000				
5	3	7.80	39	4.00	20	0.60	3	0.00	0	0.00	0	0.05292	0.02415	0.00340	0.00000	0.00000				
1	8	8.00	8	0.00	0	0.00	0	0.00	0	0.00	0	0.39801	0.00000	0.00000	0.00000	0.00000				
9	9	15.33	138	11.89	107	1.56	14	0.11	1	0.00	0	0.13061	0.09828	0.01284	0.00171	0.00000				
13	12	52.69	685	4.69	61	1.00	13	0.00	0	0.00	0	0.40704	0.03539	0.00739	0.00000	0.00000				
2	13	40.00	80	8.50	17	2.00	4	0.00	0	0.00	0	0.39212	0.08390	0.01983	0.00000	0.00000				
10	14	64.80	648	4.90	49	0.70	7	2.00	20	0.00	0	0.26745	0.01503	0.00225	0.00514	0.00000				
34	15	46.00	1564	7.56	257	1.53	52	1.00	34	0.06	2	0.28357	0.04062	0.00863	0.00508	0.00027				
23	16	52.09	1198	22.52	518	3.17	73	2.48	57	0.00	0	0.18982	0.05720	0.00819	0.00621	0.00000				
24	17	39.13	939	9.33	224	1.50	36	4.04	97	0.54	13	0.27422	0.05742	0.00923	0.02765	0.00408				
12	20	27.58	331	5.42	65	1.33	16	0.08	1	0.00	0	0.16435	0.03299	0.00790	0.00049	0.00000				
TOTAL UNITS MEASURED= 180		TOTAL 0+ STEELHEAD 7426		TOTAL 1+ STEELHEAD 1571		TOTAL 2+ STEELHEAD 268		TOTAL 0+ CHINOOK 216		TOTAL 0+ COHO 15										

Fish numbers and densities per habitat type (area in square meters).

FISHERIES HABITAT EVALUATION HANDBOOK

230 - Step III - PROJECT DESIGN AND EVALUATION231 - Step III Process.

231.1 - Objectives. The objective of Step III is to provide site specific information for the design and evaluation of habitat restoration/enhancement project work, and evaluation of adjacent/off-site watershed management activities.

231.2 - Standards. Standards of Step III relate to statistical reliability. Data collected for Step III shall be statistically reliable to the degree that errors are no greater than 5 percent.

231.3 - Equipment. Equipment needed to perform Step III varies from case to case depending on the type of project, but generally will include all equipment listed for Step II.

231.4 - Procedure. The fish biologist/hydrologist shall use standard methodology and state-of-the-art techniques for project specific reconnaissance mapping, hydrological surveys and project level habitat typing.

231.5 - Management Uses. These include project specific monitoring, and evaluation of timber, range, and watershed management programs, such as:

1. The monitoring program for the South Fork of the Trinity River, being conducted by the Six Rivers and Shasta-Trinity National Forests.
2. Instream flow studies.
3. Allotment management and timber sale harvests.
4. Surveys needed to assess impacts of reservoirs proposed on stream courses.
5. Evaluations needed for fish habitat improvement and enhancement projects to determine feasibility and success.
6. Integrated resource management.

231.6 - Outputs. Outputs will be similar to Step II and reflect the type of study, and may vary according to the intensity and need. The project report should include a description of the study area, a description of the problem, the objectives of the study, a description of the methods used, a discussion of the study results, and critique of the methods. Send copies of the report to the California Department of Fish and Game and other cooperators, as appropriate.

FISHERIES HABITAT EVALUATION HANDBOOK

240 - STEP IV- FISH HABITAT RELATIONSHIP (FHR) PROGRAM.241 - Step IV Process.

241.1 - Objectives. The objective of Step IV is the collection of fish species information and life history data. This data when related to habitat quality and quantity (Step II), is one component of watershed limiting factor analysis, and quantification of the biological response to habitat changes.

241.2 - Standards. Standards of Step IV relate to statistical reliability. Data collected for Step IV shall be statistically reliable to the degree that errors are no greater than 5 percent.

241.3 - Equipment. Equipment needed to perform Step IV depends on the objectives of the study or research.

241.4 - Procedure. The fish biologist/fish scientist shall use state-of-the-art hydrological and biological sampling procedures in the design and implementation of fish habitat relationship research and studies. For information and support contact the Inland and/or Anadromous Fish Habitat coordinators.

241.5 - Management Uses.

1. Limiting factor analysis.
2. Evaluation of habitat restoration/enhancement techniques.
3. Project cost-effectiveness analysis.
4. Cumulative effects of watershed activities.

241.6 - Outputs. The development of networks between the forests and other agencies for the exchange of FHR information. This can be accomplished through DG networks, FHR Currents (R-5's Fish Habitat Relationship Technical Bulletin), and research publications. There are many examples of FHR studies throughout Region 5. Contact the coordinators for more information.

